Personalize Learning Management System Platform using Artificial Intelligence Rule-Based Technique

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Abstract- ***This mixed-method research utilizing descriptive-developmental design is about designing and evaluating Personalize Learning Management System Platform using Artificial Intelligence Rule-Based Techique employs an incremental prototyping model in the development. Consultative meetings, interview and the used of survey questionaires were held to obtain data from 10 information technology experts as the alpha evaluators and 10 teachers who is practicing ICT education as the beta evaluators chosen using purposive sampling. Results show that personalize learning management system is excellent in terms of functional suitability (M=4.70), performance efficiency (M=4.80), compatibility (M=4.85), usability (M=4.80), reliability (M=4.80), security (M=4.71), maintainability (M=4.69), portability (M=4.76) recording a grand mean of 4.76 interpreted as excellent. This means that the system satisfies both software quality standards and end-user requirements. Thus, it is ready for adoption. Along with its implementation, it is recommended to gather feedback regularly conduct and conduct an impact analysis of the effectiveness of using the personalize learning management system platform using artificial intelligence rule-based technique.***

Indexed Terms- ***Prototyping model, LMS, Artificial Intelligence, Rule-based technidue, Philippines, Platform***

I. INTRODUCTION

Today, with the rapid growth of technology, computer learning has become increasingly integrated with artificial intelligence techniques in order to develop more personalized educational systems. Customizing a learning environment to optimize personal learning has recently become a popular trend in e-learning. Because creativity has become an essential skill in the current e-learning. The innovation of information and communication technologies plays an important role in the popularity of e-learning. E-learning can be supported through different forms like web-based learning, computer-based learning, or virtual classrooms and content delivery via e-networks, audio or video tape, satellite TV, video conferencing, CD-ROM, ipods, e-mails, wireless and mobile technology.

According to the study of Jaiswal and Arun (2021), technology-enabled systems support a variety of blended learning methods, including web- or computer-based instruction, instructor-led or self-paced instruction, and individual or team-based instruction. By identifying students' learning paths, these systems assist teachers in enhancing students' learning experiences. The distinctions in the learning process arise because learning requires an individual to construct new ideas or concepts based on their knowledge, skills, abilities, and/or experience. Artificially intelligent systems are aware of these distinctions and adapt to students' varying learning styles and aptitudes.

According to Khaled (2021), Personalization in LMS refers to the functionality that enables the system to uniquely address a learner's needs and characteristics, such as levels of expertise, prior knowledge, cognitive abilities, skills, interests, preferences, and learning styles, in order to increase a learner's course satisfaction and performance. The customization can ensure that learners receive individualized attention based on their needs.

Also, as all academic institution clearly see the potential of flexible learning as the new norm in education, HEIs have already acknowledge the benefit of integrating learning management system to support student learning environment.

AI as an educational tool has a thirty-year history. It facilitates adaptive learning environments and other educational competencies that are flexible,

customized, and effective. AI used in an educational environment can illuminate the 'black box of learning' and can provide deep, wide, and a more fine-grained understanding of student learning.

Most Learning management system infrastructures follow this approach, where similar learning resources and and assessment are provided to students, which leads to similar learning preferences.

Personalization in LMS refers to the functionality which enables the system to uniquely address a learner's needs and characteristics such as levels of expertise, prior knowledge, cognitive abilities, skills, interests, preferences and learning styles so as to improve a learner's satisfaction and performance within the course. The personalization can ensure that learners' get different attention, according to their needs.

New educational systems should appear to ensure the personalization of learning contents. This work aims to develop a new personalization approach that provides to students the best learning materials according to their preferences, interests, background knowledge, and their memory capacity to store information.

The ultimate goal of LMS is to provide differentiated learning. Differentiated learning is designed to customize the course materials and contents tailored to the needs of each students. Its main goal is to provide individualized learning. It is a method of teaching in which content, instructional technology and pace of learning are based upon result of assessment of each learner.

Addressing this problem is crucial as learning management system's main goal is to improve student learning capability for different types of learners. With this, the researcher aims to integrate artificial intelligent agents that will provide a mechanism to provide differentiated learnings. These agents are powered with rule based that will serve as its platform engine. In addition, they system can extract students learning paths which is vital to identify which topic and subjects are difficult in order to provide necessary academic interventions.

II. OBJECTIVES OF THE STUDY

This study aimed to design and develop a Personalize Learning Management System Platform using Artificial Intelligence Rule-Based Technique.

Specific objectives included designing and developing the salient features of personalize learning management system using artifitial intelligence, and used Artificial Intelligence agents that be used to provide personalized learning approach to LMS platform and then evaluating the system using International Organization for Standardization/International Electro-technical Commission standards. (ISO/IEC 25010, 2011) functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability.

A. Conceptual Framework

Figure 1 is the IPO model for the development of the system. The proponent first gathered adequate data for the system's construction, after which the data was processed, and the design, coding, and testing phases began. The study's outcome is a fully functional personalize learning management system platform using arifitial intelligence rule-based technique. Feedback was incorporated into the application to help it improve.

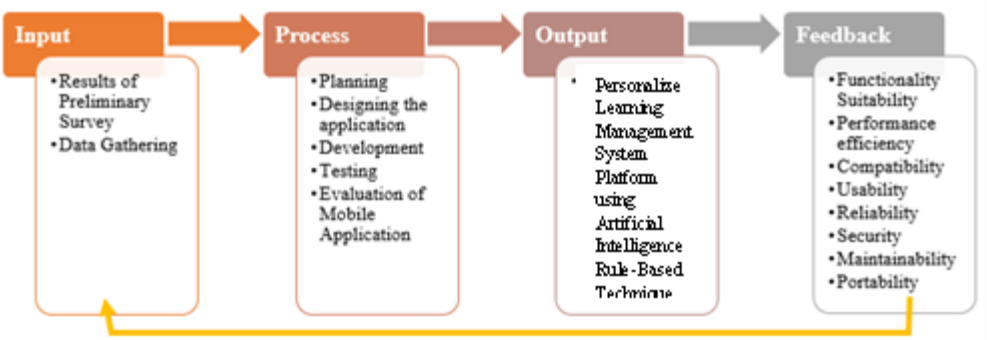


Figure 1. IPOF model for the development of Personalize Learning Management System Platform using Artificial Intelligence Rule-Based Technique (Ch 1 Universal Systems Model, 2022)

B. Scope and Delimitation of the study

The Personalize Learning Management System Platform using Artificial Intelligence Rule-Based Technique is developed. It includes test creation and automated feedback features. The system are able to be initiated at any point of time depending on what students have learned. The system provides the questions to the students. Each question are categorized according to digital Bloom's Taxonomy, to help the users identify their strengths and weaknesses. The analysis showed the category that has the highest score as well as the lowest. The analysis and feedback shown in the form of graphs and texts. The system is accessible on any Android device through web hosting.

III. METHODOLOGY

A. Research Design

The researchers used the mixed-method approach utilizing a descriptive-developmental research design and survey questionnaire technique to efficiently gather data and establish a systematic way of developing a system for its client.

The mixed-method approach is an emergent research methodology that facilitates the systematic integration of quantitative and qualitative data within a single investigation or sustained inquiry program. In this study, such integration enables more comprehensive and synergistic data utilization than possible by collecting and analyzing the survey results and interview responses data separately.

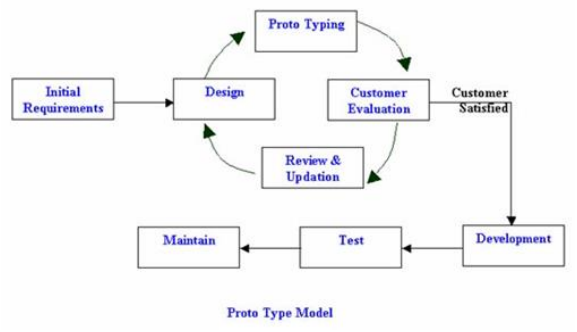
The descriptive method characterizes the features of a studied population or phenomenon. It does not address concerns regarding how, when, or why the features emerged. Instead, it responds to the inquiry "what". As Akhtar (2016) stated: In qualitative research, a descriptive method of data collecting allows for collecting correct data and creating a clear image of the phenomenon under study.

The researcher used this method to gather data from its client through interviews, questionnaires, and observations. This enabled them to understand the important content of the personalize learning management system platform using artificial intelligence.

The developmental method is one in which the object of the study is not merely knowledge but the knowledge that practitioners can use. The researcher was created a system utilizing data mining technique and incremental prototyping model as methodology to systematically plan all aspects of this study, specifically the development phase of the Personalize Learning Management System Platform using Artificial Intelligence Rule-Based Technique.

B. System Development Procedure

The researcher used incremental prototyping model in terms of the development of the application. In incremental Prototyping, the final product is decimated into different small prototypes and developed individually. Eventually, the different prototypes are merged into a single product. This method is helpful to reduce the feedback time between the user and the application development team.



Proto Type Model

The prototyping model is a systems development method in which a prototype is built, tested, and then reworked as necessary until an acceptable outcome is achieved from which the complete system or product can be developed. The main constructs of iterative prototyping are represented below:

Requirements – the requirements needed for the project are gathered and analyze. The iteration should eventually result in the requirements phase that produces a complete and final specifications and requirements.

Design – It creates the software solution that will meet the requirements of the client. This can be a new design or solution or continuation of a previous design or solution.

Prototype - It is based from the initial requirements. The researcher will crate the first iterative prototype. The scope of the prototype gets bigger as the researcher identifies more and substantial requirements.

Review - The software is evaluated, and current requirements is reviewed whether if there will be changes and addition to the requirements. Incremental Model was used because of its advantages.

The iterative prototyping model is more flexible since it has less cost to change the scope and requirements. is easy to test and debug because of its small iteration.

A rule-based system is a system that applies human-made rules to store, sort and manipulate data. In doing so, it mimics human intelligence.

To work, rule-based systems require a set of facts or source of data, and a set of rules for manipulating that data. These rules are sometimes referred to as IF then ELSE.

The researcher aims to create a rule engine to make the system more dynamic and flexible so proper adjustment can be made in terms of assessment scores and where agents can occur. This engine binds all agents and where these agents communicate with each other.

In requirement analysis the first phase of the incremental model, the product analysis expertise identifies the requirements. And the system functional requirements are understood by the requirement analysis. To develop the software under the incremental model, this phase performs a crucial role.

The second phase is design and development of the incremental model. The design of the system functionality and the development method are finished with success. When software develops new practicality, the incremental model uses style and development phase.

In this phase of incremental model is testing, the testing phase checks the performance of each existing function as well as additional functionality. In this phase, the various methods are used to test the behavior of each task.

Phase 4 is implementation, it enables the coding phase of the development system. It involves the final coding that design in the designing and development phase and tests the functionality in the testing phase. After completion of this phase, the number of the product working is enhanced and upgraded up to the final system product.

C. Participants of the study

These personalize learning management system platform using artificial intelligence rule-based technique respondents include information technology (programmer) (alpha evaluator) and Teacher who has been practicing ICT education (beta evaluator) was evaluated the system who will look into the technicality, interface and contents of the system. The evaluators were chosen using a non-probability,

purposeful sampling technique. This sampling technique required the researcher to exercise judgment in selecting the most helpful sample for the study. Table 1 shows the respondents of the study.

Domain	Number of Respondents	Description
IT Experts	10	Faculty who are IT professionals who was involved in systems development projects
Teacher	10	Teacher who is practicing ICT education.

Table I. RESPONDENTS OF THE STUDY

D. Research Instruments

The main instrument for gathering data will be the questionnaire. This is adapted from ISO/IEC 9126-1:25010: 2011. ISO/IEC 9126-1:25010: 2011 consists of quality standards, namely: Functional Suitability, Performance efficiency, Compatibility, Usability, Reliability, Security, Maintainability, and Portability. Permission was asked from the prior researcher who utilized the instrument and was subsequently granted.

E. Data Gathering

The results and data for this study would collect using the survey form via electronic means. The respondents would give a standardized set of questions based from the constructs of ISO/IEC 25010 to measure the user acceptability of the system. Confidentiality of the survey sheets shall be assured since the respondents are not known by the researcher. The survey forms will distribute after finishing the testing phase of the proposed system.

The respondents were selected information technology experts (programmer) and Teacher who has been practicing ICT education.

In gathering the data, the researcher carried out the following procedure:

1. A letter was sent to the Dean to ask permission in the conduct of proposed study.
2. With the approval of the Dean, the researcher distributed the questionnaire via electronics means to the respondents personally.
3. The researcher collected the questionnaires from the respondents and checked whether all the questions are answered.

IV. RESULTS AND DISCUSSION

A. Design and Development of the salient features of Personalize Learning Management System Platform using Artificial Intelligence

The salient features of the Learning Management System Platform are the following:

Log In – One of the security features of the system. To track information, history of the users entering the system.

Log Out – To secure the account hidden, and track history to exit the system.

Adding Teachers - Teachers plays the main role in planning, creating materials and resources, arranging the environment to maximize efficiency, monitoring students' progress, anticipating potential problems.

Managing Teachers – Organizing procedures and the utilization of resource material, teachers account, viewing classroom activities, quizzes, and management. It also allows to manage roles, add and edit users.

Adding Courses (Subjects) – This part of the system where the teachers can add courses based on the subject handled.

Manage module - This feature delivers learning materials. Delivery is not limited to uploading courses but matching which piece of content goes to whom.

Adding Lessons - Teachers can create, upload, edit or modify their lessons in the system. Also, it organizes content according to courses and can assess learning of the students each lesson.

Adding Test bank - It is the compilation of test questionnaires from the previous lessons it can be a database for future use.

B. Alpha, Beta, and Gamma Evaluation of the Student eHandbook Packet Mobile Application for BulSU Bustos Campus

This section presents the evaluative results of the Personalize Learning Management System Platform using Artificial Intelligence Rule-Based Technique. The order of presentation of findings is arranged according to the evaluation results from the two groups: the IT experts, and Teachers who is practicing ICT education using the ISO/IEC 9126-1:25010: 2011.

TABLE II. SUMMARY OF IT EXPERT'S EVALUATION (ALPHA EVALUATORS)

Indicators	WM	Verbal Interpretation
Functional Suitability		
Functional Completeness	4.70	Excellent
Functional Correctness	4.40	Excellent
Functional Appropriateness	4.40	Excellent
Average Mean	4.63	Excellent
Performance Efficiency		
Time Behaviour	4.70	Excellent
Resource Utilization	4.90	Excellent
Capacity	4.60	Excellent
Average Mean	4.73	Excellent
Compatibility		
Co-Existence	4.90	Excellent
Interoperability	4.90	Excellent
Average Mean	4.90	Excellent
Usability		
Appropriateness recognizability	4.40	Excellent
Learnability	4.90	Excellent
Operability	4.90	Excellent
User-error protection	4.70	Excellent
User-interface aesthetics	4.90	Excellent
Accessibility	4.90	Excellent
Average Mean	4.78	Excellent
Reliability		
Maturity	4.90	Excellent
Availability	4.80	Excellent
Fault tolerance	4.80	Excellent
Recoverability	4.80	Excellent
Average Mean	4.82	Excellent
Security		
Confidentiality	4.60	Excellent
Integrity	4.80	Excellent
Non-repudiation	4.80	Excellent
Accountability	4.60	Excellent
Authenticity	4.90	Excellent
Average Mean	4.74	Excellent
Maintainability		
Modularity	4.80	Excellent
Reusability	4.50	Excellent
Analyzability	4.80	Excellent
Testability	4.80	Excellent
Average Mean	4.73	Excellent
Portability		
Adaptability	4.60	Excellent
Installability	4.80	Excellent
Replaceability	4.80	Excellent
Average Mean	4.73	Excellent
Grant Mean	4.75	Excellent

Table 2 shows the alpha evaluation of the system from the IT Expert's. It got a grand mean of 4.75, interpreted as excellent. With all the standard quality indicators recording an excellent evaluation, compatabilility got the highest average mean rating of 4.90. On the other hand, functional suitability got the lowest average mean rating of 4.63. Thus, the researchers commit to enhancing the system's compatability.

Following the It Expert's evaluation, the Teacher who is practicing ICT education, who comprise the Beta group of evaluators, were consulted to ensure adherence to quality standards of Functional Suitability, Performance Efficiency, Compatibility, Usability, Reliability, Security, Maintainability, and Portability, as shown in Table 3.

TABLE III. SUMMARY OF TEACHERS WHO IS PRACTICING ICT EDUCATION (BETA EVALUATORS)

Indicators	WM	Verbal Interpretation
Functional Suitability		
Functional Completeness	4.70	Excellent
Functional Correctness	4.70	Excellent
Functional Appropriateness	4.90	Excellent
Average Mean	4.77	Excellent
Performance Efficiency		

Time Behaviour	4.90	Excellent
Resource Utilization	4.90	Excellent
Capacity	4.80	Excellent
Average Mean	4.87	Excellent
Compatibility		
Co-Existence	4.90	Excellent
Interoperability	4.70	Excellent
Average Mean	4.80	Excellent
Usability		
Appropriateness recognizability	4.60	Excellent
Learnability	4.90	Excellent
Operability	4.90	Excellent
User-error protection	4.80	Excellent
User-interface aesthetics	4.80	Excellent
Accessibility	4.90	Excellent
Average Mean	4.82	Excellent
Reliability		
Maturity	4.80	Excellent
Availability	4.60	Excellent
Fault tolerance	4.80	Excellent
Recoverability	4.90	Excellent
Average Mean	4.78	Excellent
Security		
Confidentiality	4.50	Excellent
Integrity	4.90	Excellent
Non-repudiation	4.80	Excellent
Accountability	4.60	Excellent
Authenticity	4.90	Excellent
Average Mean	4.69	Excellent
Maintainability		
Modularity	4.70	Excellent
Reusability	4.40	Excellent
Analyzability	4.70	Excellent
Testability	4.80	Excellent
Average Mean	4.65	Excellent
Portability		
Adaptability	4.90	Excellent
Installability	4.70	Excellent
Replaceability	4.80	Excellent
Average Mean	4.80	Excellent
Grant Mean	4.77	Excellent

Table 3 summarizes the Teacher who is practicing ICT education evaluation using ISO/IEC 9126-1:25010: 2011 quality standards. The overall rating for the system is excellent *(M = 4.77).*

Table 5 presents the overall ratings of IT experts, and Teachers who is practicing ICT educations using ISO/IEC 9126-1:25010: 2011 quality standards. It was revealed that the average weighted mean was excellent (4.76). All indicators evaluated in terms of Functional Suitability, Performance efficiency, Compatibility, Usability, Reliability, Security, Maintainability, and Portability were rated excellent.

TABLE V. SUMMARY OF IT EXPERTS AND TEACHERS WHO IS PRACTICING ICT EDUCATION EVALUATION USING ISO/IEC 9126-1:25010:2011 QUALITY STANDARDS

Indicators	WM	Verbal Interpretation
Functional Suitability	4.70	Excellent
Performance Efficiency	4.80	Excellent
Compatibility	4.85	Excellent
Usability	4.80	Excellent
Reliability	4.80	Excellent
Security	4.71	Excellent
Maintainability	4.69	Excellent
Portability	4.76	Excellent
Grant Mean	4.76	Excellent

CONCLUSION

Based on the study results, it can be safely concluded that the Personalize Learning Management System Platform using Artificial Intelligence Rule-Based Technique is an excellent LMS platform. This means that the system satisfies both software quality standards and end-user requirements. Thus, it is ready for adoption.

RECOMMENDATION

In line with the preceding conclusion, the following are the deemed recommendations of the researcher derived, the creation of a mobile application supported by other mobile operating system is being recommended. Reduce bandwidth to prevent network congestion and bottlenecks, which can cause latency

problems, packet loss, and sluggish response times. Include employees in the process of learning new skills, acquiring new knowledge, and training. Training employees means showing them how to do a certain task or method that will help them do their jobs better. Consider recommendations and gather feedback regularly. Create LMS that satisfies customers by prioritizing the features that the majority of users will employ, based on their input.

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